

are so characteristic of this genus, the third pair appeared to have in their place four strong, straight, and smooth spines. The foot of the fifth pair was also different, the inner branch bearing several short spinose teeth, the outer lobe, which is hardly produced at all, bearing a single slender short seta.

If this should prove to be a new species, I would name it *Z. hamiltoni*, after the enthusiastic naturalist who has done so much to add to our knowledge of Macquarie Island.

EXPLANATION OF PLATE XIV.

Figs. 1-8. *Guerneca antarctica*. Fig. 1 $\times 56$; figs. 2-8 $\times 184$.

- Fig. 1. Body as seen from the side.
 Fig. 2. Anterior antenna.
 Fig. 3. Posterior antenna.
 Fig. 4. Mandible.
 Fig. 5. Maxilla.
 Fig. 6. Anterior foot-jaw.
 Fig. 7. Foot of fifth pair.
 Fig. 8. Caudal segments and setae.
-

ART. XXIII.—*On the most frequent Pelagic Copepods and Cladoceres of the Hauraki Gulf.*

By DR. AUGUSTIN KRÄMER, Physician H.I.M.S. "Bussard."

[Read before the Auckland Institute, 1st October, 1894.]

Plates XV.—XXIII.

DURING a stay of about four months at Auckland, from November, 1893, till February, 1894, I was able to get much "plankton" from very different parts of the Waitemata Harbour (except the interior part, beyond the Sentinel Rock), and of the Hauraki Gulf, between Tiritiri, Great Barrier Island, and Rangitoto.

By the measure of more than fifty perpendicular draughts with a volumetric plankton-net I found that the small crustacea, Copepods and Cladoceres, are abundant on every spot, together with many kinds of Diatomaceæ (*Coscinodiscus*, *Bidulphia*, *Chaetoceros*, *Trioceratium*, *Ceratium*, &c.). There are also always present a genus of Radiolaria, some Appendiculariæ, and Rotifera. As far as it is possible to work out the material on board a ship in a short time I believe that I have done it; but naturally this treatise can be no definite one: but, as

almost nothing has yet been published on the pelagic Copepods and Cladoceres, I will not delay giving a report.

What is known of the Copepods of New Zealand is contained in a treatise by G. M. Thomson, of Dunedin, published in vol. xv. of the *Transactions*; but, because his collections are "from rock-pools or shore-kelp" of the Otago Harbour, they include little beside the Harpacticidæ, which, with a few exceptions, belong to the littoral and not to the pelagic fauna.

The word "plankton" is now commonly adopted for "pelagic moulder," or "auftrieb." It means the small (microscopical) organisms floating in the sea or in a lake; and "pelagic plankton" would mean those floating free from the coast and from the bottom. The Copepods, these small crustaceans, are the most important, and never-wanting, part of the plankton.

On the volumetric draughts I shall report later, when the material is worked out. It is found that the plankton contains more species and much more individuals in the Hauraki Gulf (and in Waitemata Harbour) than in the open sea, as, for instance, outside Great Barrier Island.

Dana, in the publications of the United States Exploring Expedition, has named only four Copepods as found in the neighbourhood of New Zealand. Giesbrecht, in his excellent work on the Copepods ("Fauna und Flora des Golfes von Neapel," vol. xix.), which is also the newest and most fundamental one, including all that was known about the order up to 1892, says, on these four species, that the names of three must be changed, following the priority of authorship.

1. *Pontella valida*, Dana, is not a *Pontella*; but the genus cannot be recognized from Dana's description.

2. *Pontellina simplex*, Dana, is not a *Pontellina*, but a *Labidocera*.

3. *Miracia gracilis*, Dana, is now commonly known as *Setella gracilis*, Dana.

The fourth, *Saphirina gemma*, Dana, retains the name given by Dana. *Setella* (*Miracia*) and *Saphirina* seem to belong principally to the open sea. I found *Setella* near the Kermadec Islands, but never in the harbour. A *Pontella* has recently been found by Thomson in the Otago Harbour, and one species of *Labidocera* in the Hauraki Gulf.

Of all the Copepods recorded from the Pacific Ocean anywhere near New Zealand, I have only found two in the Hauraki Gulf—the widespread and common *Paracalanus parvus*, Claus, and *Clausocalanus arcuicornis*, Dana. *Eutерpe acutifrons*, Dana, which is invariably present in the gulf, in the Pacific has only been found in long. 108° W. and lat. 20° S., near Easter Island. All the other Copepods named below are quite new for the Pacific, and therefore also

for New Zealand; and also the Cladoceres, as far as I know.

The result of this treatise is: Altogether, twelve Copepods and four Cladoceres are found in the Hauraki Gulf, only three of which (as named above) are known from other reports for New Zealand. One genus and three species of the Copepods and three species of the Cladoceres are quite new. As to the treatise of G. M. Thomson, none of the Copepods described there have been found in the Hauraki Gulf—a proof that there is much to do still in this direction, principally with regard to the littoral fauna.

For comparison, in the very well searched harbour of Kiel, in Germany, twenty-six Copepods have been collected, of which fourteen are Harpacticidæ, all belonging to the littoral fauna; and in the sea near Naples altogether 125 (five-twelfths of all known free Copepods). It is very interesting that, of the 129 Copepods belonging to the Mediterranean, twenty-seven have never been found in the Atlantic, but only in the Pacific Ocean.

The following is a catalogue of the species which I have collected. The classification is that of Giesbrecht:—

1. COPEPODA.

1. Fam. Calanidæ.
 - (1.) *Paracalanus parvus*, *Claus*.
 - (2.) *Clausocalanus arcuicornis*, *Dana*.
2. Fam. Centropagidæ.
 - (3.) *Centropages typicus*, *Krøyer*, var. *aucklandicus*.
 - (4.) *Temora turbinata*, *Dana*.
 - (5.) *Leuckartia*, *sp.* (?)
3. Fam. Pontellidæ.
 - (6.) *Labidocera cervi*, *n. sp.* ♀.
 - (7.) *Acartia clausii*, *Giesbr.*
4. Fam. Cyclopidæ.
 - (8.) *Oithona nana*, *Giesbr.*
5. Fam. Harpacticidæ.
 - (9.) *Euterpe acutifrons*, *Dana*.
6. Fam. Oncaidæ.
 - (10.) *Oncaola specialis*, *n.g. et sp.*
7. Fam. Corycæidæ.
 - (11.) *Corycæus tenuis*, ♀, *Giesbr.*
 - (12.) *Corycæus aucklandicus*, *n. sp.*

I have not thought it necessary to give descriptions of the known species, for they are fully described in the work of Giesbrecht, and of the new genus and species I mention only the differential characters, giving references to the plates. The figures have been exactly executed with a drawing apparatus.

I. COPEPODA.

1. Fam. CALANIDÆ.

1. *Paracalanus parvus*, Claus.

Is known from several places in the Pacific, but has not been previously obtained from the immediate neighbourhood of New Zealand. In the Waitemata Harbour a few specimens only have been found, but it is very frequent in the Hauraki Gulf, especially in the Tofino Bay, where it was of a dark-red colour.

2. *Clausocalanus arcuicornis*, Dana.

Was found by Dana in lat. 32° S. and long. 178° E., near the Kermadec Islands, and by Giesbrecht in the more northern parts of the Pacific, in the depth of 4,000m. (13,000ft.). In the Hauraki Gulf a few female specimens were found near the Island of Motuhurakia. The proportions of the segments of the first antenna are nearly accurately the same as Giesbrecht mentions. The teeth of the inner margin of the basalia 2 of the pes II. and III. are conspicuous. Total length, 1·25mm.

2. Fam. CENTROPAGIDÆ.

3. *Centropages typicus*, Krøyer, var. *aucklandicus*. Plate XV., figs. 1-5.

The species has not been previously found in the Southern Hemisphere, but the nearly-related *C. brachiatus*, Dana, is recorded from the Cape of Good Hope and from the west coast of South America. Found in the Hauraki Gulf, but not generally distributed (♂ and ♀).

The hooks of the fifth segment of the thorax (fig. 5) like spines; anal segment of the male not reduced, nearly as long as the preceding. Seta externa of the furca ♂, which is twice as long as broad, not near the margin of the end.

Genital segment (1) of the female not armed with four setæ; the following segment (2) a little longer than this, and without a knob.

Fifteenth joint of the first antenna ♂ also with a big spine similarly to the sixteenth joint (like *C. brachiatus*).

Fifth foot ♂ (fig. 1). Inner branch of the hand (tongs) not so strong and short, but as long and thin as the outer.

Fifth foot ♀ (fig. 2). Thorn inside of the second joint of the ramus externus (*R.e.*) not longer than the joint itself (as long), and not standing off and not so strong.

Fourth foot. Spine outside of the second joint of the ramus externus dexter just as in *C. typicus*, Krøyer, but the end is blunt.

There are many slight differences between this variety and the old form; but it does not seem necessary to form a new species, as the general similarity is great. I have therefore distinguished it as *var. aucklandicus*.

4. *Temora turbinata*, Dana.

Described by Dana from the Sulu Sea, and by Giesbrecht from Hongkong and Amoy. Is very common in all parts of the harbour and gulf in all states of development, the young having a red wing on each side of the body.

5. *Leuckartia*, Claus, sp. (?).

Only one specimen found in the gulf. Was recognized as a *Leuckartia* for certain, but, as the species would be a new one, and there is the possibility that the specimen was juvenile, I only notice the presence of this genus for further examinations.

3. Fam. PONTELLIDÆ.

6. *Labidocera cervi*, n. sp. ♀. Plate XVI., figs. 6 and 7.

I only found one specimen, a female, in the Hauraki Gulf. The species is a new one, and belongs to the group of *L. orsinii*, *nerii*, and *pavo*. Length of the thorax, 2·3mm.; of the abdomen and furca, $\frac{1}{3}$ mm. The appearance is like that of *L. nerii*. (Imm. = $\frac{1}{2}\frac{1}{5}$ in.)

Head without a crista, but with a long rostrum (as long as the first joint of the first antenna, fig. 6).

Antenna I. as *L. brunescens* (Giesbr., tafel 23, fig. 7).

Antenna II. as *L. kröyeri* (Giesbr., tafel 23, fig. 23).

The ramus internus is shorter, with four long and one short setæ on the end. Mandible, maxilla, maxillipeds, like *L. wollastoni*.

The last joints of the four swimming-feet are armed as follows:—

		Pes I.	Pes II.	Pes III.	Pes IV.
Ramus externus,	{ Outside thorax	2	3	3	3
third segment	{ Inside setæ	4	5	5	5
Ramus internus,	} Setæ	6	8	8	7
second segment					

The most characteristic part is pes v. and the two-segmented abdomen. Pes v. (fig. 7) is a little similar to that of *L. pavo*, but the hooks are stronger, like the horn of a stag of ten antlers.

The rami externi of the fifth feet of the four species are characterized as follow:—

	On the End.	On the Outside Margin.
<i>L. orsinii</i>	1 point.	..
<i>L. nerii</i>	3 points of middling size.	..
<i>L. pavo</i>	3 points of middling size.	2 small points.
<i>L. cervi</i> , n. sp.	3 large points.	2 large points.

The abdomen is nearly the same as that of *L. nerii* and *orsinii*, but the fifth foot of these two is very different. On the contrary, the fifth foot is a little like that of *L. pavo*, but of this the abdomen is very different. Therefore it seems to be necessary to form a new species.

I have only found one female. There is also the female only of *L. orsinii* and *pavo*, Giesbrecht, known from the Red Sea. *L. nerii* ♂ and ♀ has been found in the Pacific, near the equator, like most other species of *Labidocera*.

7. *Acartia clausii*, Giesbr.

Has previously only been found in the Northern Hemisphere. It is always present in the harbour and gulf.

4. Fam. CYCLOPIDÆ.

8. *Oithona nana*, Giesbr. Plate XVII., figs. 1-9.

Very common throughout the harbour. It is peculiar that this species has only recently been found by Giesbrecht at Naples, and not elsewhere.

Setæ terminales of the furca feathered (fig. 1), and, as well as the end of the abdomen, of a dark-red colour, reminding one of the same parts of the related *Thorellia brunnea*, Boeck, var. *antarctica*, found by Thomson in the Otago Harbour (vol. xv., p. 95, pl. v., fig. 19).

Oithona similis, Claus, seems also to be present in the harbour, or perhaps some other species; but time did not allow me to identify all the specimens.

5. Fam. HARPACTIDÆ.

9. *Eutерpe acutifrons*, Dana.

Has already been found in the Pacific, near Easter Island, as mentioned before. This Harpacticid is one of the few pelagic ones very common in all parts of the harbour and gulf, males and females.

6. Fam. ONCÆIDÆ.

Oncæola, nov. gen.

Appearance *Cyclops*-like, and therefore like *Oncaea*.

Antenna I. 6-jointed.

Antenna II. 4-jointed.

First and second maxillipeds different.

The principal difference is that the ramus internus of the fourth foot is not nearly as long as the ramus externus, but much smaller, and of the same form and size as the fifth foot, which is a staff of middling size and armed with two setæ on the end.

Only found a few female specimens in the Waitemata Harbour.

10. *Oncæola specialis*, n. sp. Plates XVIII., and XIX., figs. 1-9.

Size, 0·8mm.; thorax, 0·5mm.; abdomen and furca, 0·3mm.

Antenna I. 6-jointed (fig. 2), fourth joint scarcely longer than the following. No æsthetascs.

Antenna II. 4-jointed (fig. 3).

Maxilliped I. (fig. 4) like a cock's comb.

Maxilliped II. (fig. 5) both not of equal size.

Swimming-feet I., II., III. (fig. 6) all equal.

Seta interna of the second joint of the ramus externus and of the first joint of the ramus internus much stronger in the proximal part than on the end.

The third joint of the ramus externus of foot III. has, as in foot IV., three thorns, and is only about as long as the first and second joints together.

Swimming-foot IV. (fig. 7a). Ramus internus staff-like, 2-jointed; first joint small, second joint long, with two setæ on the end.

Foot V. (fig. 8). A one-jointed staff, with two setæ on the end, just as the ramus internus of the fourth foot.

Abdomen 5-jointed, the first segment bearing the fifth foot-pair. Second genital segment as long as the three following, the form like a pear, with a knob and three small spines upon it (fig. 8). Furca (fig. 9) a little longer than the preceding anal (fifth) segment of the abdomen.

7. Fam. CORYCÆIDÆ.

11. *Corycæus tenuis*, Giesbr. ♀.

Only one female specimen found in the Hauraki Gulf. The species has only been previously described by Giesbrecht from the west coast of Central America, and also a female only. My specimen was recognized without doubt as *C. tenuis*, and it is to be hoped that the male will also be discovered in New Zealand. I was led to search specially for this species because the following new species (*C. aucklandicus*), which is very common in the harbour, is very nearly related to it; and I am glad to say that in this search I was at length successful.

12. *Corycæus aucklandicus*, n. sp. Plate XX., figs. 1-10.

I named it *aucklandicus* because this Copepod seems to be a very steady and common inhabitant of the Auckland waters; males and females frequent.

Total length, 1·2mm.

The new species belongs to the group *C. lubbockii* and *tenuis*, which are distinguished from the other *Corycæi* by the reduced ramus internus of the fourth swimming-foot.

Antenna I. 8-jointed.

Antenna II. (fig. 4, ♂ ; fig. 6, ♀) } Claws of particular form,
 Maxilliped II. (fig. 5, ♂ ; fig. 7, ♀) } as the figures show.

Swimming-feet I., II., III. (pes I., fig. 8 ; pes III., fig. 9).

Ramus externus and internus of every foot 3-jointed.

Swimming-foot IV. (fig. 10). Ramus externus 3-jointed.

Ramus internus reduced, small, with two long setæ.

The abdomen is 2-jointed (fig. 2, ♂ ; fig. 3, ♀). The first genital segment bears one long and one very short seta. The second anal segment is smaller than the first. The male bears on the under-margin of the first segment a small hook (fig. 2), as in *C. obtusus*, which it resembles altogether much more than the female of the new species resembles the female of *C. obtusus*.

The proportions of abdomen and furca are as follow :—

	(1.) Genital Segment.	(2.) Anal Segment.	Furca.
<i>C. lubcockii</i> , ♀	9	4	11
<i>C. tenuis</i> , ♀	7	4	8
<i>C. aucklandicus</i> , ♀	7.5	4	5
♂	14	5	8

II. CLADOCERES.

I little hoped when I began my examination of Auckland Harbour to find so many kinds of Cladoceres—three of the four genera belonging to the saltwater: *Podon*, *Evadne*, *Penilia*, missing only *Bosmina*. Three of the four species are new. They are as follow :—

1. Fam. Podontidæ.

(1.) *Podon polyphemoides*, *Leuckart*.

(2.) *Podon trisetosus*, *n. sp.*

(3.) *Evadne aspinosa*, *n. sp.*

2. Fam. Sididæ.

(4.) *Penilia pacifica*, *n. sp.*

As before, I only give a short description, the figures showing best the differences.

1. Fam. PODONTIDÆ.

I. *Podon*, Lilljeborg.

Head straight, separated from the body by a small incision.

1. *Podon polyphemoides*, *Leuckart*. Plate XXI., figs. 1-5.

The species is frequent in the Baltic Sea, and is also abundant in the Hauraki Gulf. To distinguish the different species of *Podon* it is necessary to mark the setæ of the small ramus externus (appendix externus) of the four swimming-feet. A comparison of the old species and the new one shows as follows :—

		Pes I.	Pes II.	Pes III.	Pes IV.
Setæ of the ramus externus of	{ Podon leuckartii, Sars ..	1	1	1	2
	{ " intermedius, Lillj. ..	2	1	1	2
	{ " schödlerii, Czerni. ..	2	3	3	1
	{ " polyphemoides, Leuck.	3	3	3	2
	{ " trisetosus, n. sp. ..	3	3	3	3
	{ " schmackeri, Poppe.	4	4	4	2

The new species is, as already named,

2. Podon trisetosus, n. sp. Plate XXI., figs. 6–8.

Every ramus externus is armed with three setæ. There is also a good mark of difference between the two Auckland species in the large antenna (figs. 2 and 8); for the setæ of the 4-jointed ramus are distributed as follows:—

		P. polyph.	P. trisetosus.
Setæ of	{ 1st joint ..	0	0
	{ 2nd joint ..	0	1
	{ 3rd joint ..	2	1
	{ 4th joint ..	4	4

P. trisetosus is very scarce in the harbour and gulf.

II. Evadne, Lovén.

Head depressed. Not separated from the body by an incision.

Only one species has been found; it is new. Having no spine like *Evadne spinosa*, which I afterwards found in Jervis Bay, near Sydney, together with this new species, I called it

3. Evadne aspinosa, n. sp. Plate XXII., figs. 1–8.

The body is round (fig. 1). The setæ of the ramus externus of the swimming-feet are 2, 3, 3, 1; the two setæ of the first appendix (fig. 6) are longer and stronger than the following. This bisetose appendix is a very good mark to distinguish this *Evadne* from *Podon* if the form of the body is not quite conspicuous, as sometimes occurs.

2. Fam. SIDIDÆ.

Genus *Penilia*, Dana.

Dana described two species—*P. avirostris*, from Rio Janeiro, and *P. orientalis*, from the Sunda Strait. I give the details in the description of the species from Auckland.

4. *Penilia pacifica*, n. sp. Plate XXIII., figs. 1–5.

Thomson knew of the presence of a *Penilia* in the Bay of Islands. As I have found it first in the Auckland Harbour, and afterwards in Port Jackson (Sydney), it seems that this species is common in the southern Pacific, and therefore I gave the name *pacifica*. At first I found one specimen in the Waitemata Harbour; only in February in Tofino Bay, and in

the open gulf, there was a large number in all states of development. At times the number was so large that of ten organisms in the draught one was a *Penilia*. No males were found; they seem to live at another time. The females had nearly all some eggs or embryos (I saw once eight) in the brood-bag.

In the middle of the head, one eye surrounded with crystal lenses (fig. 3, *d*); one rostral spine on each side of the head (figs. 1, 2, 3). Behind the rostrum *the first antenna*, a small one-jointed palpus with some short setæ on the end (fig. 2) (one larger and some smaller). *The second antenna* (fig. 4) is long (the rowing-antenna) and two-branched; each branch is two-jointed. The ramus externus (*R.e.*) bears six setæ on the last (2) and two on the first segment. The ramus internus (*R.i.*), four and one. Each segment is armed with a small spine. Behind the eye is the heart (fig. 3, *c*), and between the eye and heart a secondary eye (*b*). On each side of the heart is a sucking-disc (*a*).

The integument of the body, the shell, covers six leaf-shaped feet (branchipods), and is slightly denticulated on the margin. The form of the shell in reference to the head and the abdomen is best seen in fig. 1, and described below in comparison with the species of Dana.

The length of the animal is about 1mm. ($\frac{1}{25}$ in.).

The abdomen (fig. 5) is armed with two long stylets, each bearing two small thorns (a longer and a shorter one). The stylets are about as long as the abdomen. Two long setæ (about as long as the body) are placed on two appendages of the upper part of the abdomen.

The difference between the three species is,—

P. AVIROSTRIS.

P. ORIENTALIS.

P. PACIFICA.

Shell.

Posteriorly over the middle of the back excavated; anteriorly forming an acute angle with the head.

Posteriorly shallow excavated; anteriorly forming no acute angle with the head.

Posteriorly a little excavated; anteriorly forming an acute angle with the head.

Setæ of the Dorsal Appendages of the Abdomen.

Not so long as the caudal stylets, barely reaching to the base.

Long, reaching beyond the apex of the stylets.

Very long, reaching far beyond the apex of the stylets (as long as the body).

Palpus (Ant. I.).

Present.

| No palpus.

| Present.

As I mentioned above, I also found *P. pacifica* in Port Jackson, and another new and distinct species in the crater-lake Lanuto'o, in Samoa, 2,000ft. above the level of the sea.